



Utilization of Pulp and Paper Manufacturing By-Products for Biofuels (plus Biopower & more!)

Cleaner Technology and Energy Efficiency:
Structuring for Competitive Advantage
Workshop by
The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Office of Technical assistance and Technology

Managing Director: Dr. Hemant Pendse, **FBR i**



FBRI Vision

To advance understanding about the scientific underpinnings, system behavior, and policy implications for the production of forest-based bioproducts that meet societal needs for materials, chemicals and fuels in an economically and ecologically sustainable manner



New Business Opportunity

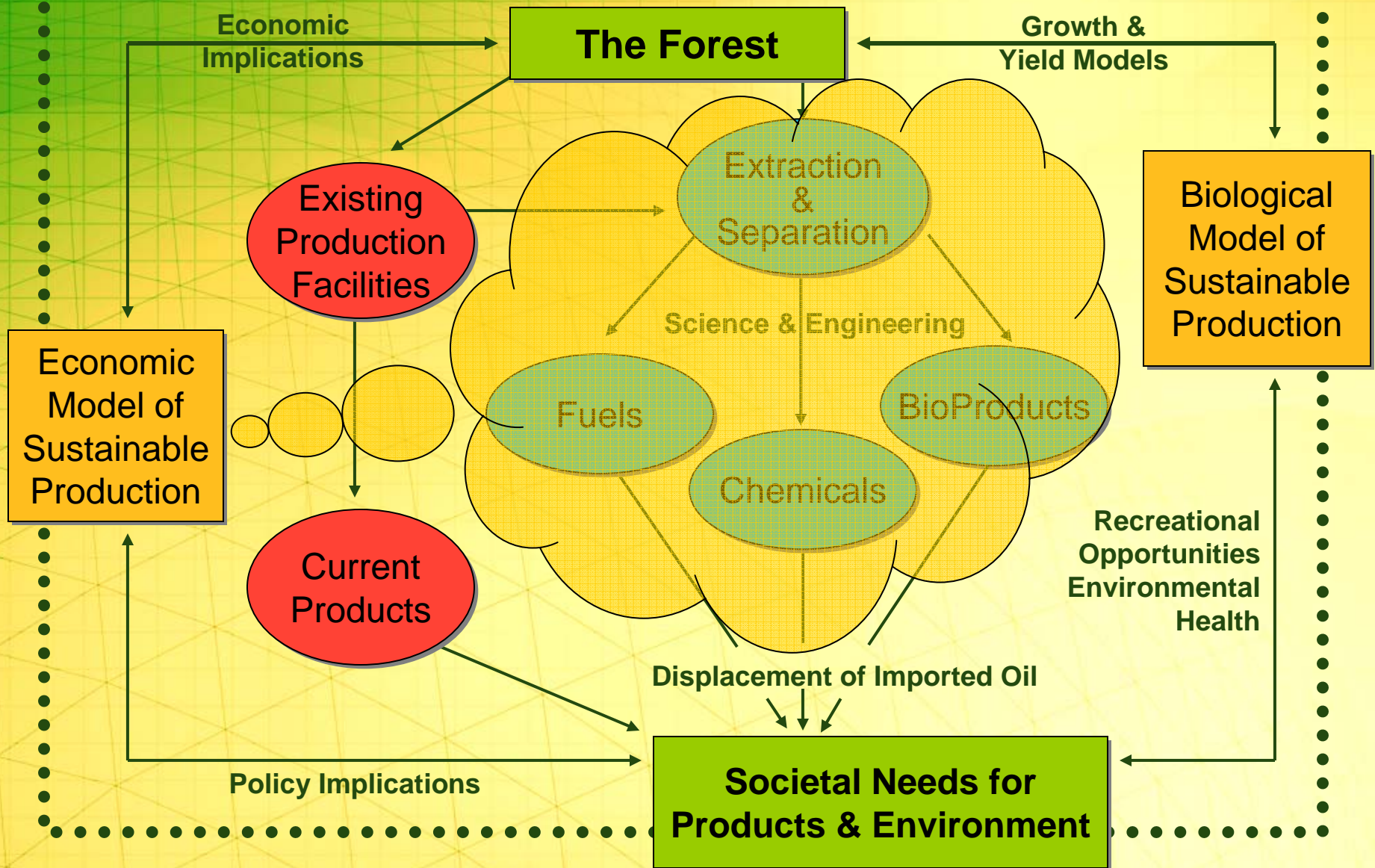
- Forest Landowners
- Biomass Power Plants
- Sawmills & OSB plants
- Pulp Mills

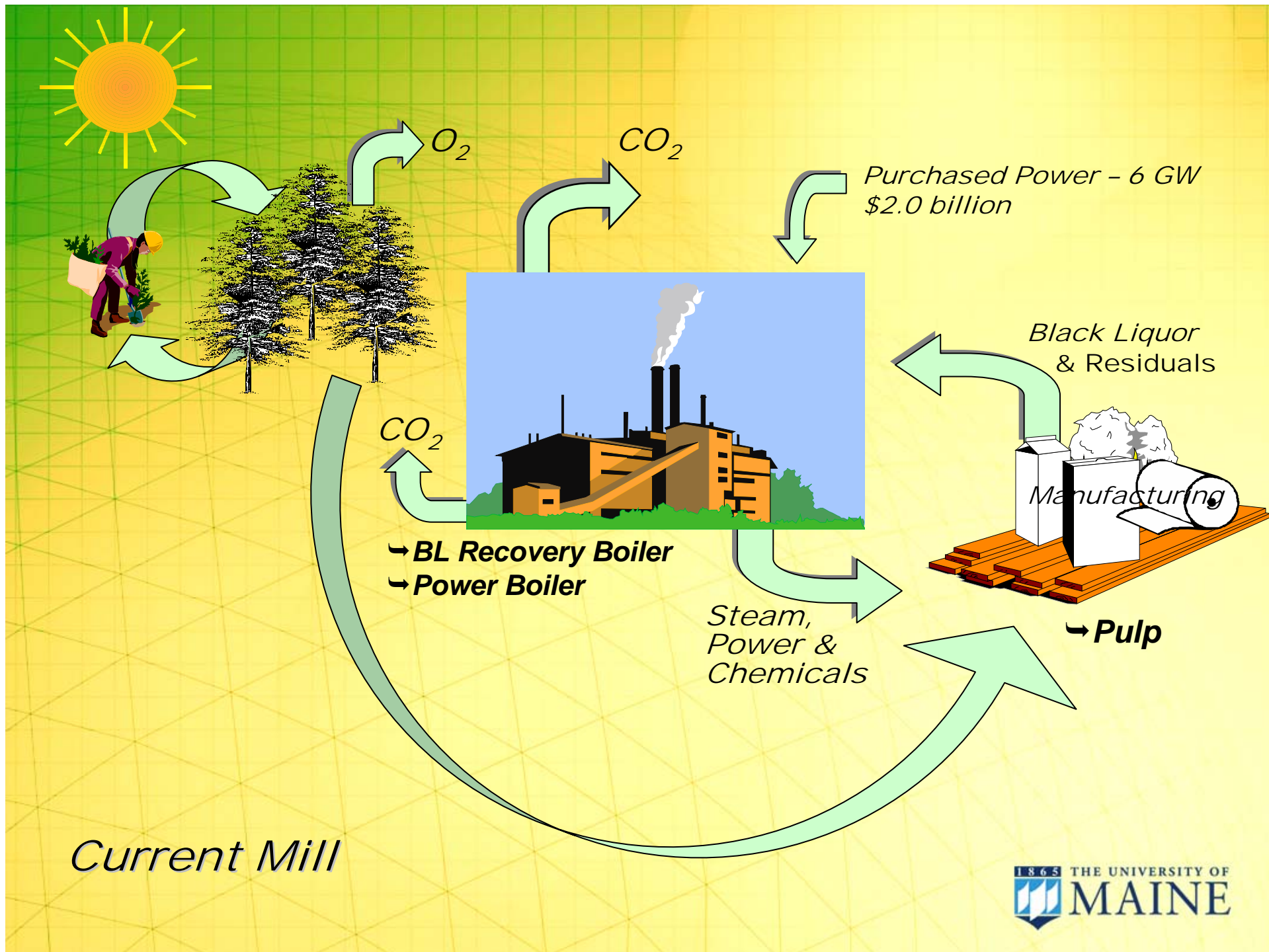
**Imagine
what we
can do
together**

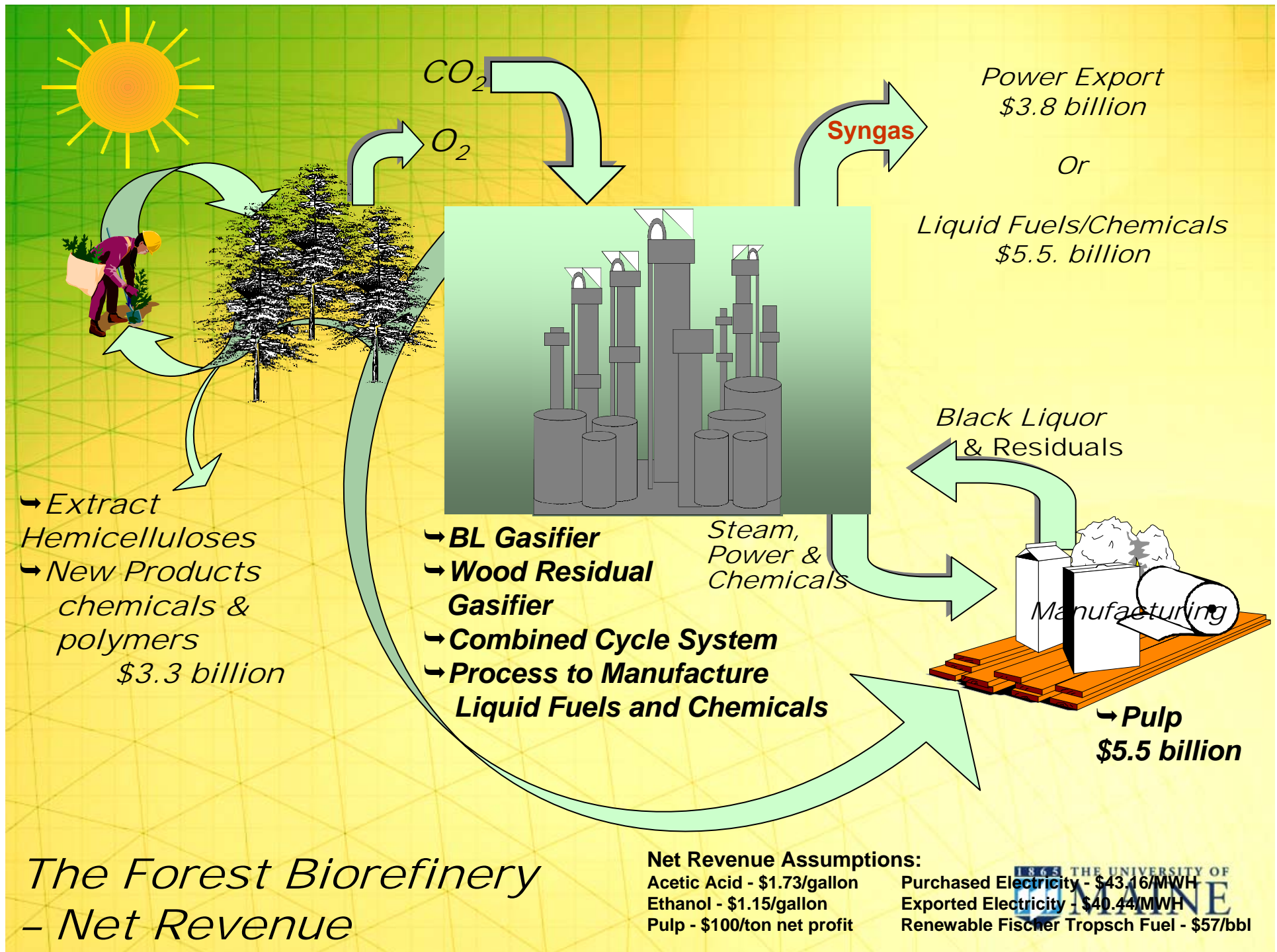
Innovation/Technology-based Economic Development for the “New Economy”

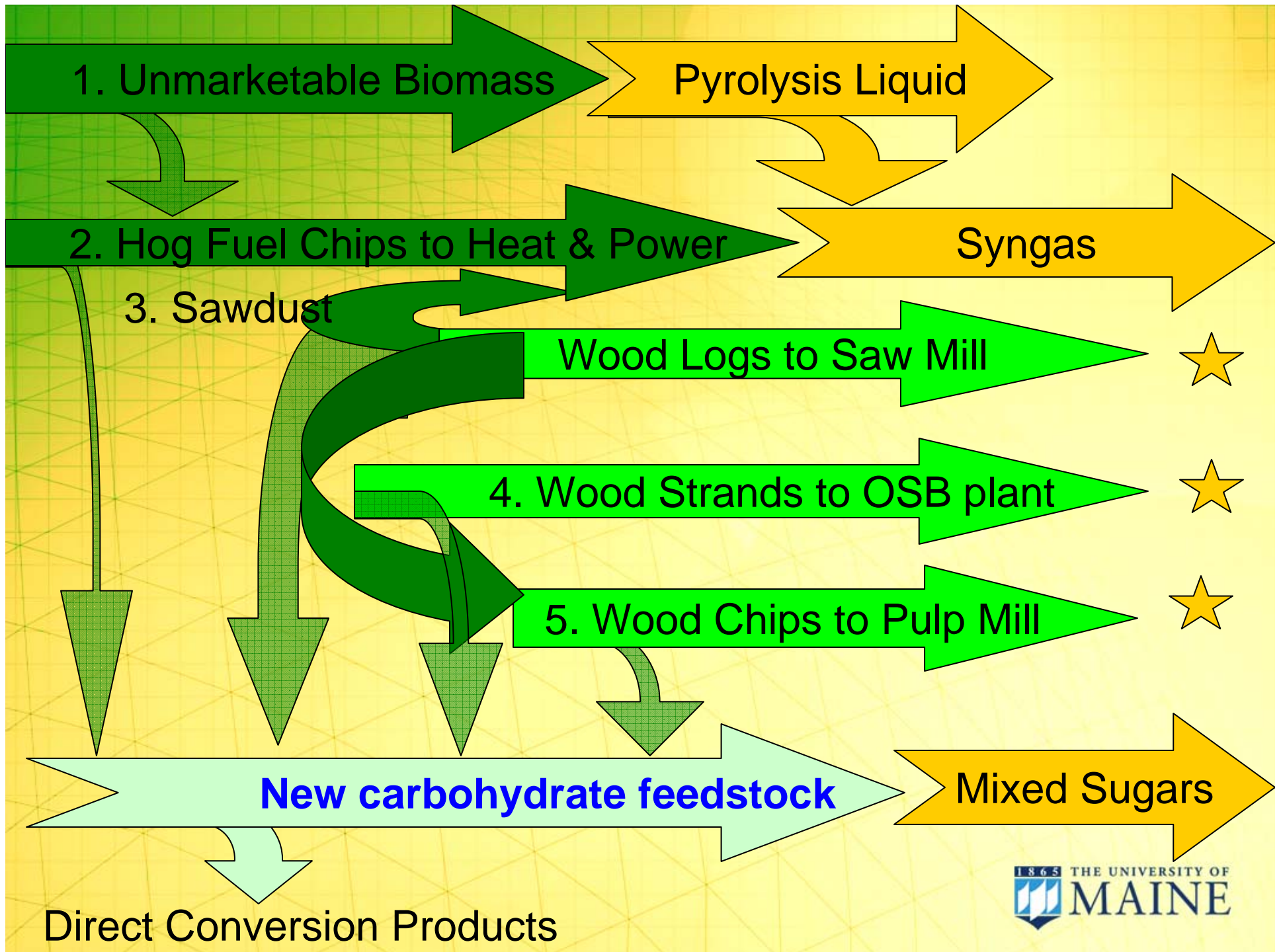
	Basic Research	Applied Research	Development & Commercialization
Science & Technology Development			
Industrial Problem Solving		MAFES PDC	MAFES PDC
Technology Financing		MTI seed grants	MTI development awards

Life Cycle Assessment

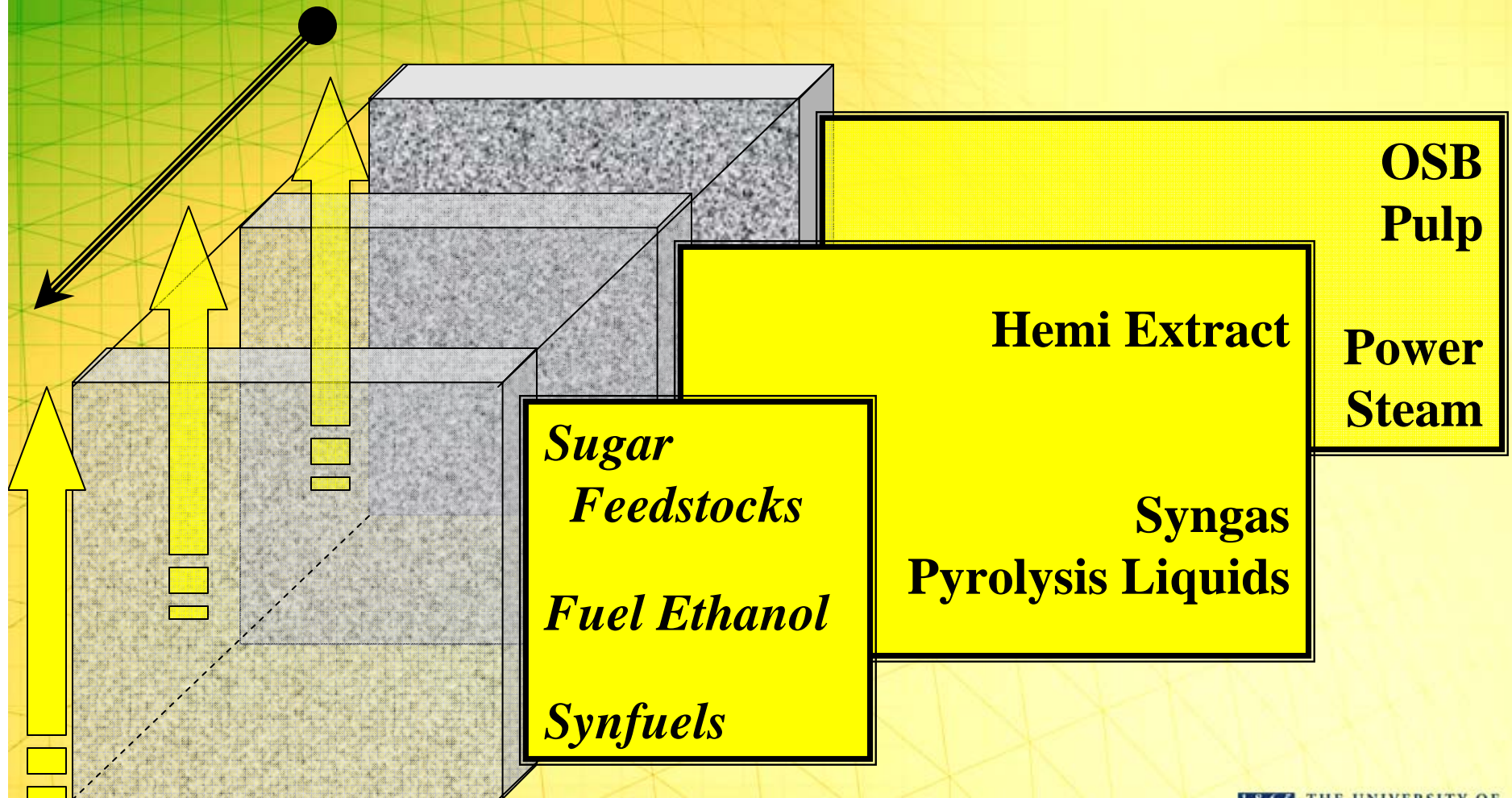






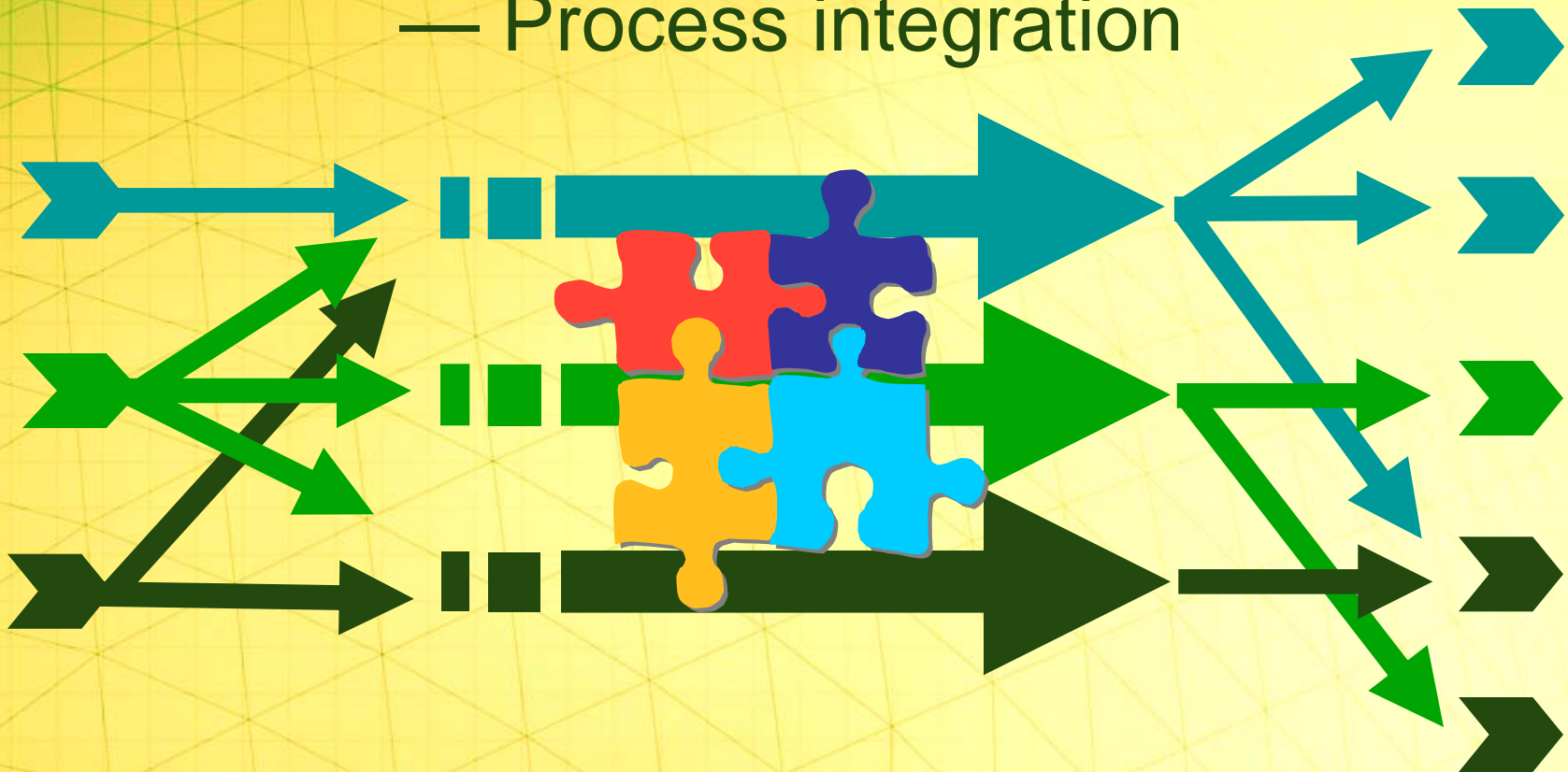


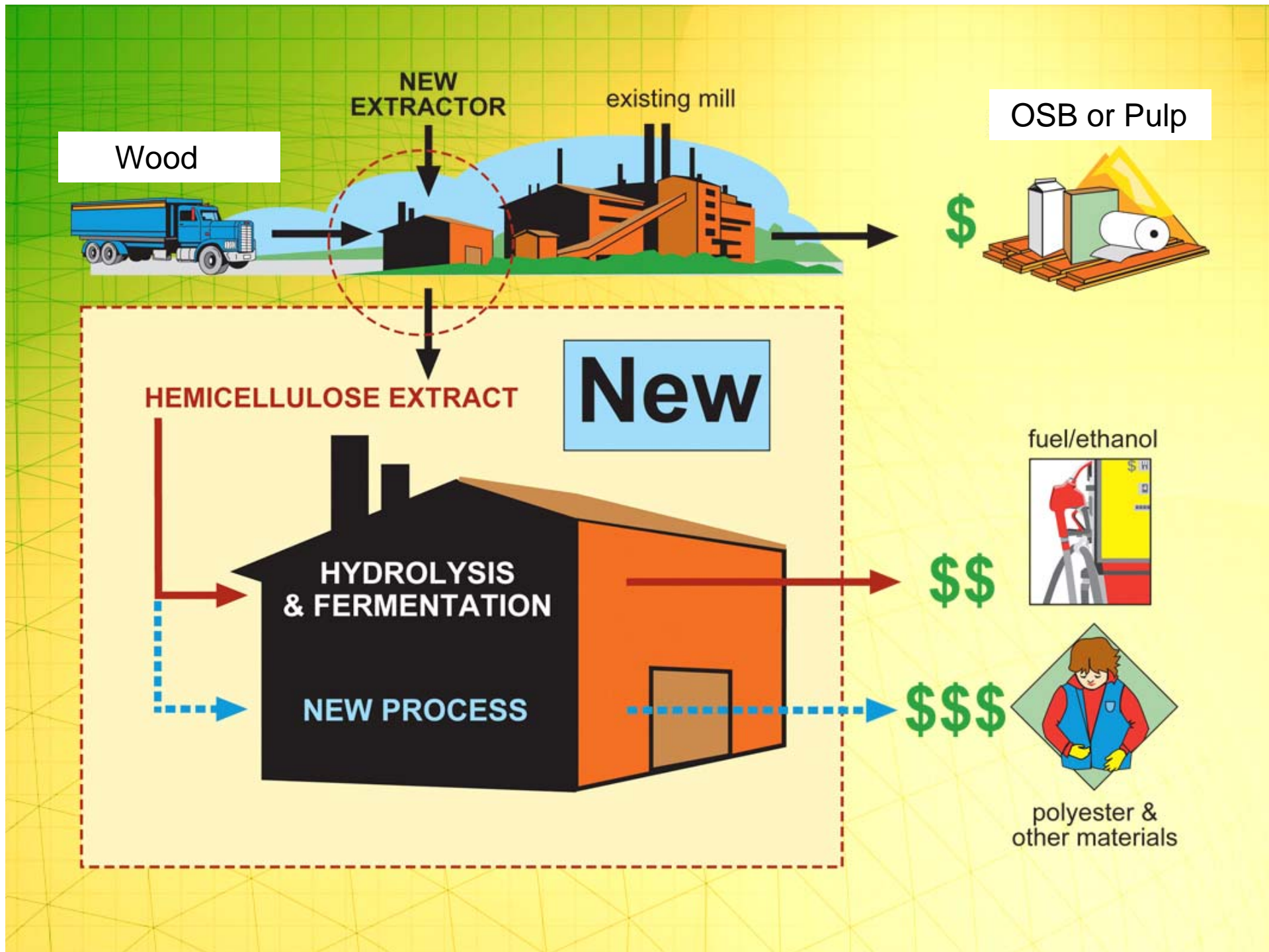
Forest Biorefinery



Integrated Forest Biorefinery Platform

- Multiple feedstocks
- Adjustable product mix
- Process integration





The Case for the Wood

- Available year round and easily stored
- High density is positive for shipping
- Low in ash and sulfur content
- Can sustain and enhance rural economic development
- Does not compete with food or animal feed markets
- Much better energy ratio for ethanol production
- Well-developed infrastructure exists for growth, harvesting, transportation and processing
- In many areas, wood processing facilities are located near agricultural activities offering co-processing opportunities

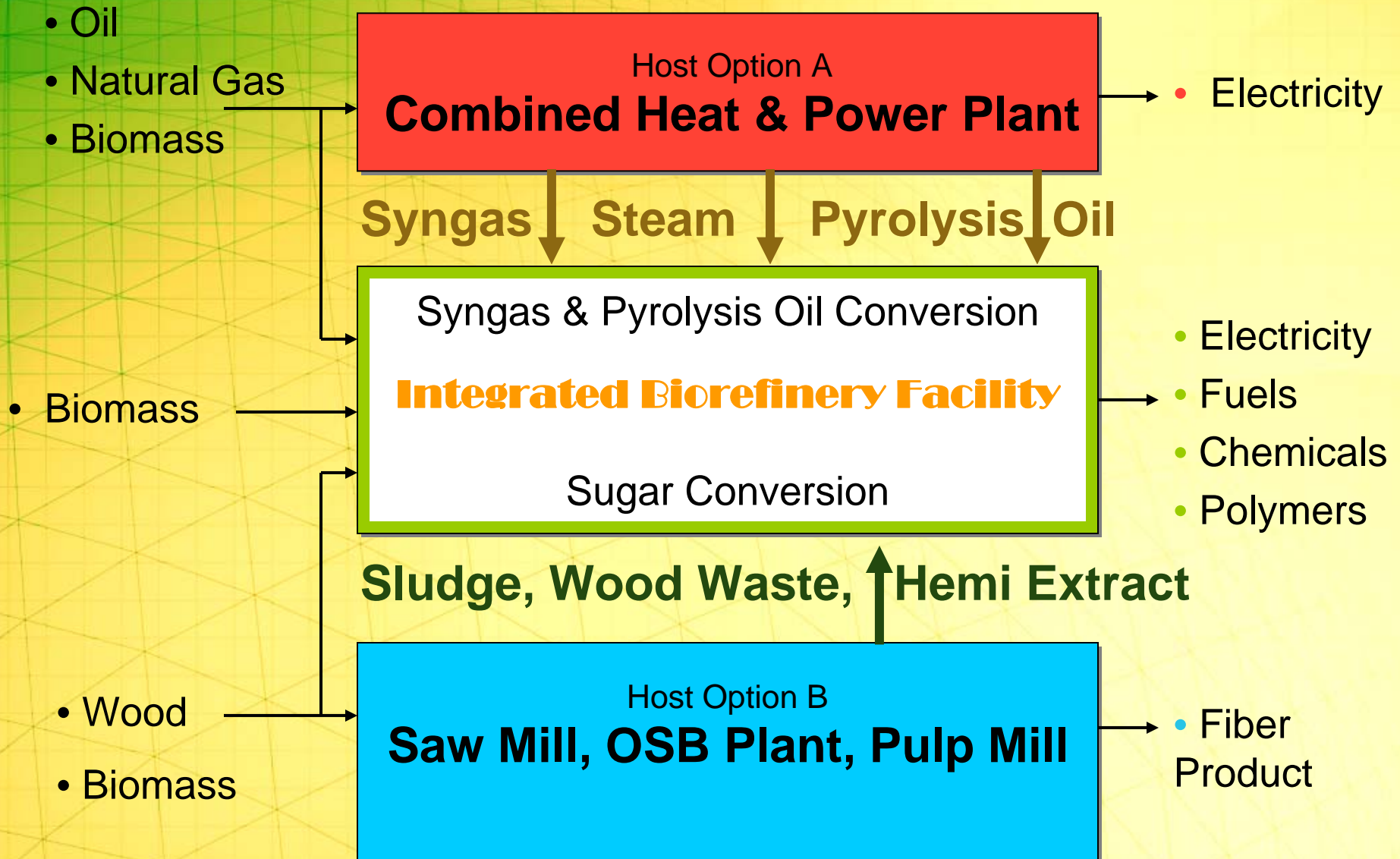
Advancing Forest Biorefinery through No Sulfur No Chlorine Operation

- Use BGCC for high energy conversion efficiency
- Use sulfur-free lignin feedstock
- Use hemicellulose extract for biopolymers
- Use cellulose in fiber form

- Sulfur-free Pulping
- Oxygen Delignification
- Ozone Bleaching

Green Chemistry

Forest Biorefinery Platform



New England Green Chemistry Program Consortium (NEGCC)

- **University of Maine (Lead Institution)**
 - Extraction of Biomass Components
- **University of Massachusetts, Amherst**
 - Purification and monomer conversion
- **University of Connecticut**
 - Polymer Processing
- **University of Vermont**
 - Polymer Characterization
- **University of Rhode Island**
 - Sustainability and Life Cycle Analysis
- **University of New Hampshire**
 - Applications of New Materials
- **University of Massachusetts, Lowell**
 - Environmental Considerations



We have regional platforms.



Resource Plan



Research Infrastructure

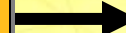
NSF EPSCoR
DOE EPSCoR
\$13M
Research Personnel
Bench/Lab Scale
Analytical
Batch Processes



Pre-Processing Center

State R&D Bond
& Private Funds
\$5M

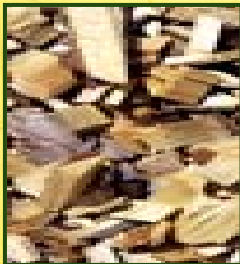
Large Scale
Pre-treatment,
Hemi Extraction
Biological and
Thermochemical
Conversion
of Biomass



Integrated Biorefinery Semiworks Demo Plant

Private Funds/Govt Grants
\$20-\$200M

Co-located at:
Co-Gen site
Pulp mill
OSB/OSL Plant
Saw Mill
Industrial Cluster



Forest Bioproducts
Technology Development

<http://www.forestbioproducts.umaine.edu/>

Industry and business leaders have an opportunity to get a seat at the table for advice, collaboration and direction.



E-mail: forestbioproducts@maine.edu

